

The INL developed CIPR/sim technology provides first responders with real-time consequence analysis information.



CIPR/sim

A comprehensive, real-time critical infrastructure modeling technology

When a natural disaster or terrorist attack occurs, the time it takes to mobilize, deploy and coordinate response and recovery efforts by first responders can mean the difference between life and death. In today's environment, catastrophic natural events including hurricanes, tornados and wildfires hinder public safety and economic stability by damaging or destroying critical infrastructures necessary for a healthy, functioning society.

In the aftermath of Hurricane Katrina, research performed by both federal agencies and private companies has demonstrated that returning communities to a normal state hinges on several key elements. Those elements include ensuring

responders are adequately prepared prior to an incident, are capable of responding quickly during an incident, and have the knowledge necessary to make accurate decisions throughout the crisis.

In cooperation with the Department of Defense, scientists and engineers at Idaho National Laboratory have developed an advanced simulation technology – called CIPR/sim – that allows emergency planners to visualize the real-time cascading effects of multiple infrastructure failures before an actual emergency occurs. By using CIPR/sim, responders are better prepared, and more responsive and accurate when analyzing critical incident data.

What is CIPR/sim?

In 2007, a team of INL critical infrastructure protection engineers, geospatial technology experts and software developers began designing CIPR/sim to help first responders plan, prepare and predict the cascading effects that natural disasters or terrorist attacks have on infrastructure resources such as the electric power grid and telecommunication networks.

In just nine months, CIPR/sim has become the first critical infrastructure simulation tool to be designed with a common operating framework that adheres to national Institute of Electrical and Electronics Engineers (IEEE) standards. This advancement allows the tool to import real-time data from numerous existing

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The Energy of Innovation



INL infrastructure protection experts analyze the effects of a earthquake on the electric power grid using CIPR/sim.



These combined benefits provide emergency planners with access to a wide variety of complex data streams in an easy-to-understand format. The format requires little or no interpretation, allowing users to make competent, time-sensitive decisions like the placement and quantity of support resources.

Crisis Response

To improve response and restoration efforts, the integration of advanced simulation technology into first-responder practices is an important step forward. The development of technology such as CIPR/sim enables first responders to run multiple scenarios of various disasters in their infrastructure sectors of interest. This exercise builds understanding and experience. Consequently, crisis action plans are more accurate and complete, logistics support plans are refined, and the communities are better prepared for emergencies. CIPR/sim becomes a valuable tool for training community leaders, emergency response personnel and emergency management leaders.

In today's world, it is a well-established fact that both natural and man-made disasters will affect infrastructure resources and likely cause them to temporarily fail during an emergency. When disasters strike, the real-time nature of CIPR/sim enables emergency response personnel to build situational awareness of the evolving crisis and allows them to predict the resulting impacts. This knowledge sharpens the decision process, enabling faster and better command decisions that ultimately enhance the efficiency of the emergency personnel, allowing them to save more lives and restore the community back to health.

For more information

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analysis modules, including RTDS (Real Time Digital Simulator) for electric grid analysis, QualNet for telecommunications analysis and PC Tides for wind speed and flood surge analysis.

By incorporating independent module analysis into a single simulation, emergency planners are provided with an integrated checks-and-balances system where each infrastructure module builds on the information provided by the other. The result is a highly accurate situational awareness portrait of how a disaster scenario will play out and what infrastructures will be affected throughout the course of the incident. For instance, if CIPR/sim indicates an emerging storm system will affect the functionality of a particular substation, emergency planners also have access to information about how severely cell towers, pumping stations or hospitals in the region will be impacted by the damaged substation. This information is displayed for emergency planners in two distinct formats.

The first method uses a two-dimensional design that provides users with a spatial context of the tool's results. The user interface has a

GoogleEarth® look and feel for intuitive operator commands that include a series of data-rich charts and graphs for in-depth analysis. The second method is a three-dimensional design that provides users with additional insight not usually witnessed at the height of a disaster or attack. This immersive display is created in a photo-realistic format commonly seen in industry-leading gaming environments. The users have the ability to move freely within the created environment and can view and replay a disaster's impact from multiple angles and perspectives. Both designs vividly display infrastructure damage or destruction in a color-coded real-time format.

In addition to providing a method and standard for linking modules, CIPR/sim allows emergency planners to create and run virtually any kind of natural or man-made incident. During demonstrations at INL, scenarios have shown the impact of earthquakes, hurricanes and deliberate physical attacks on infrastructures within major U.S. cities. Data for these demonstrations was displayed in real time by CIPR/sim through links established to existing RTDS, QualNet and PC Tides modules.